

very old carp 'rest on very unreliable evidence,' and adds that, 'although there is good reason for believing that under artificial conditions this fish may attain to a good old age, it is doubtful whether it exceeds fifteen years in a wild state.' This, I think, aptly sums up the position in the case of carp, since these placid fish take very easily to a domestic life.

Both authors are equally sceptical about the alleged great age of certain pike, though Dr. Regan concedes 'it is probable that fish of sixty or seventy pounds weight are at least as many years old.' Mr. E. G. Boulenger (*Angling*, October-December, 1936, page 7) states that 'no pike of over fifteen years is *definitely recorded*' (my italics). Ireland, as is well known, produces some superb pike; yet, so far as I am aware, scale readings, where practicable, have not revealed any evidence of notably long-lived individuals. One of the heaviest Scottish pike netted in recent years—a female fish weighing 35 lb., and measuring 4 ft. in length (Loch Ken, 1935), was estimated, from examination of scales, to be eighteen to twenty years old (*Fishing Gazette*, June 29th, 1935).

Unfortunately, numerous discrepancies are to be found between various authors' accounts of 'long-lived' carp and pike. In some cases even the metal of which the marking ring was composed differs in different stories, some writers having that it was brass, others copper, and yet others insisting on gold! Gesner's marked pike, taken (*circa?*) 1497, was supposed to have been placed in a lake by the Emperor Frederick II in the year 1230, but, as Mr. Norman has pointed out, '. . . they (*i.e.*, other authors) cannot agree as to which of the Fredericks was responsible for marking the fish, or as to the exact locality at which it was finally captured. Its length has been stated to be 19 ft., and its weight *five hundred and fifty pounds*' (my italics).

Incidentally, it would appear that the Teutonic sense of humour was more pronounced in those times than now; for we read (I really must apologise to Mr. Norman for quoting him so extensively!) that the actual skeleton of this monster pike is said to be preserved in the cathedral at Mannheim, but 'a celebrated German anatomist' who studied it during the last century 'found that the vertebrae in the backbone were too numerous to belong to a single individual—in other words, that the skeleton had been lengthened to fit the story!'

'DAVENA,'

56, CRANMORE LANE,

ALDERSHOT,

HANTS.

PETER MICHAEL.

XXIV.—ON THE NESTING HABITS OF THE GOURAMI. (*OSPHRONEMUS GORÁMY* [*LACÉPÈDE*]).

The nesting habits of Anabantoids are interesting in that the male constructs a floating nest of air bubbles to the under side of which are attached the eggs deposited by the female. The paternal parental care lasts till the absorption of the yolk in the

young larvae which after this are capable of leading an independent existence. The spawning habits of *Colisa fasciata* (*Colisa vulgaris*) and *Osphronemus goramy* which are essentially alike have been given by Carbonnier (1876 and 1877). The breeding habits of *Macropodus chinensis* (*M. opercularis*) are also apparently the same in view of the reference made by Carbonnier in his paper (Carbonnier, 1876). Waite (1904) has given an account of the breeding habits of the Siamese fighting fish, *Betta pugnax* Cantor. There is a short note on the breeding habits of *B. splendens* by Chute (1935). The nesting habit of a South Indian form, *Macropodus cupanus* (*Polyacanthus cupanus*) has been worked out by the present writer (Jones, 1939) and this has been found to be just as in the other Anabantoids.

While engaged in going through the literature connected with the breeding habits of the Anabantoids, the author was surprised to find divergent nesting habits attributed to the Gourami by different workers. The observations of Carbonnier (1877) on the nesting habits of this form is in general agreement with that of other Anabantoids. A few extracts from his account are given below. 'He' (referring to the male fish) 'soon commenced in one of the angles of the aquarium the formation of a nest of froth, which in a few hours attained a considerable size—6 to $7\frac{1}{4}$ inches in diameter and 4 to $4\frac{3}{4}$ inches in height.' The life of the bubbles depends on the quantity of mucus contained in them and the fish appears to make a selection of the good bubbles. 'For this purpose he kept at the surface of the water, turning his back to the nest, and drawing in the outer air, expelled it by degrees in front of him in the form of gaseous bubbles. The badly preserved bubbles burst, and there only remained those the envelop of which possessed suitable consistency; these he then collected and carried into his nest.' 'At times the buccal secretion seemed to slacken, and the male could no longer elaborate his globules. He then descended to the bottom of the water to seek for some confervae, which he sucked and chewed for a few moments as if to excite and reawaken the activity of the mucous membrane.' With regard to the behaviour of the male after the eggs have been deposited by the female he says 'A *Macropodus* or *Colisa* would not have been embarrassed about collecting the eggs and arranging them in his mouth; and in order to raise them to the surface he made use of a most curious stratagem. He rose to take in an abundant provision of air; then, descending, he placed himself well below the eggs, and suddenly, by a violent contraction of the muscles of the interior of the mouth and pharynx, he compelled the air collected there to escape by the gill apertures. This air, infinitely divided by the branchial lamellae and fringes, was, so to speak, pulverized; and the violence of the expulsion was such that it escaped in the form of a regular gaseous powder, which enveloped the eggs and conveyed them to the surface.' It takes three days for the eggs to hatch out (Temp. $25^{\circ}\text{C.} = 77^{\circ}\text{F.}$) and the paternal care lasts for about another ten days. About 2,000 to 3,000 eggs are laid at a time, and the fish has the faculty to spawn several times a year,

The nesting habit of the Gourami as given by other workers is quite different from the one given above. No reference is made of a floating nest consisting of air bubbles. Weber and de Beaufort (1922), say: 'The eggs are attached to water plants or received in a nest, composed of plants.' Deraniyagala (1929), dealing with the Labyrinthici of Ceylon, says 'This fish is reported to breed when six months old and builds a bird-like nest of mud and weed, to which the ova are attached. The young according to Indian workers, hatch out after a month and are guarded by the parents.' Sundara Raj (1931) in a pamphlet issued by the Madras Fisheries Department says, 'During the breeding season nests are constructed by the fish in the weedy margins of the pond with stems and blades of grass and aquatic plants (*Elodea*, *Ceratophyllum*, *Hydrilla*, etc.) and in these the eggs are deposited by the female. The male generally guards the nests. The young fry emerge from the eggs in about a fortnight but if the weather is warm, in shorter times.' In the Fisheries Department Aquarium at the Madras Beach (Marina) the nest of a Gourami resembling very much the nest of a bird can be found exhibited in a show case.

In no other Indian fresh water fish so far as I know a definite nest made of water weeds or grasses is recorded. Apart from the Anabantoids eggs attached to floating mass of air bubbles are not known in any other Indian Fish. In the Ophiocephalids, where we get floating eggs, bubbles of air are absent and the eggs are self-buoyant due to the presence of a large oil globule. Budgett (1901) when dealing with breeding habits of some West African fishes refers to frothy floating egg masses in the case of the Characinid, *Sarcodaces odoe*. In *Gymnarchus niloticus* and *Heterotis niloticus*, two other West African fresh water fishes, nests made out of water weeds are recorded (Budgett 1901).

It is evident from the extracts given already that the nesting habits of the Gourami are different according to different workers. It is rather strange that the same species should exhibit such varied habits. We find that the observation of Carbonnoid does not differ from the typical nesting habits of the Anabantoids and therefore one is disposed to consider it as more probable. However this is an interesting problem that requires further investigation.

Since writing the above account a few more references concerning the nesting habits of the Gourami have come to the notice of the writer and the relevant portions in them are given below. It has not however been possible to consult the works of Dabry de Thiersant¹ and of General Hardwicke.²

Gilbert has given in this *Journal* (1894, vol. viii, Part 3, pp. 435-8) the following notes on the breeding habits of this form that he observed in an aquarium of about 15 gallon capacity with some ornamental rock work at the bottom consisting of a central curved stone: 'One morning when I came as usual to look at

¹ La pisciculture et la pêche en Chine, 1872.

² *Zool. Journ.*, iv, p. 309.

my fish I noticed that some thing unusual had happened; all the fish but one had hidden themselves amongst the weeds and the only visible fish was truly terrifying spectacle. He had turned a jet black and his red eyes by contrast, shone like live coals; his fins were all erect, and he was making furious charges at any of the other fish which ventured to show their noses. Presently I espied another black-looking fish quite motionless underneath the rock-work bridge, and then I understood what was taking place. After chasing away all intruders the male came down to the female under the bridge.'

Immediately after they separated the female emitted a stream of 15 or 20 eggs, and to my disgust the pair immediately set to work (apparently) to gobble them up. One or two eggs which were caught in the eddies and carried down amongst the rocks were immediately snapped up by the other fish which were hanging around for this purpose. This took place several times and at last I noticed that the pair had frequent mysterious visits to the undersides of the hollow stone, but there was nothing there that I could see.'

The next morning these visits were explained and I then noticed the female frequently rising to the surface and bringing down with her a mouthful of air which she let go against the underside of the bridge until there was a large silvery globule accumulated. The eggs had, it appeared, been plastered to the underside of the rock and she was now supplying them with air.'

Every now and then the globule would overflow and a large bubble would rise to the top; she however kept on bringing down more air with the idea, I suppose, of keeping the supply fresh.'

I have already mentioned that these fish seem capable of actually breathing atmospheric air, but what the eggs should want with air, and compressed air at that, I leave others better versed in fishlore to explain. The eggs could hardly have been less safe had the parents put them on the top of a floating leaf, as one or other had to remain constantly on guard to keep away the other fish.'

Another point struck me, which was the great self-denial exhibited by the pair, and more especially by the male; these eggs seemed to be regarded by the other fish as great delicacies, and I could quite imagine a bad husband (and I suppose there are such things amongst fish as amongst other animals) bolting his mouthful of eggs and explaining the contretemps and excusing himself on the grounds of a sudden inclination to cough.'

Jordan in 1905 in his *Guide to the study of Fishes* referring to the work of Hardwicke says (p. 166) 'General Hardwicke tells how the Gouramy (*Osphromenus gouramy*) in the Mauritius, forms a nest amongst the herbage growing in the shallow water in the sides of tanks'. Here one cannot say for certain what kind of a nest he refers to.

Sundararaj (1916, *Rec. Ind. Mus.*, xii, p. 281) while dealing with the fresh water fish of Madras after referring to the works of the previous authors on the subject says 'the nest is of a nearly spherical form composed of plants, preferably tuft of a

peculiar grass (*Panicum jumentorum*) which grows on the surface of the water, and considerably resembles a bird's nest in form. It is usually attached to plants or weeds growing at the edge of the pond and the bottom selected is muddy while the depth varies.' According to Darby de Thiersant in natural surroundings the eggs are attached to water plants.

J. A. Thomson in his *The New Natural History*, vol. ii, p. 533 says 'At the breeding season it makes a nearly spherical nest of water grass and the like, and usually fastens it to plants growing at the margin of the Pond. At this time the fish assumes a jet black colour and flashing red eyes, and becomes very pugnacious in defence of the nest. The Gourami is one of those fishes that can use dry air gulped in at the surface and a very interesting fact is that every now and then the mother brings down a mouthful of air and discharges it upon the eggs, thus securing their thorough aeration. Here we have a fish puffing air on its eggs! Surely that is *experimental*.' On page 536 of the same work, under the photograph of a Gourami he says 'This malayan fresh water fish, acclimatised in India, the Guianas and Mauritius, is famous for the bubble-nest that the male constructs and guards. It is made of air bubbles entangled in a mucous secretion from the mouth. The fish itself may grow to be two feet long, and is very palatable.' The two statements are contradictory.

Boulenger (*Zoo and Aquarium Book*, 1932) gives the figure of a bubble nest of *Macropodus opercularis* (= *M. viridiauratus*) with the parent guarding the nest and producing fresh bubbles in the place of those lost.

It has not been possible for the present writer to observe the nesting habits of the Gourami. Gilbert's observations tally with those of Carbonnier in that the male makes a bubble nest as all other Anabantoids whose breeding habits are known. It is however difficult to conceive the same species exhibiting two quite different nesting habits even granting conditions are different. Habits like these are derived by instinct and as such it is impossible for them to get changed under different conditions. In the author's opinion one should consider a bubble nest as the natural and probable one in the Gourami till it is definitely proved to be otherwise.

I am indebted to Mr. S. H. Prater and Dr. S. L. Hora for clearing my doubts, regarding the nomenclature of certain Anabantoids and to Mr. L. de Fonseka of the Colombo Museum Library for sending me certain extracts dealing with the breeding habits of the Gourami.

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TRIVANDRUM.

S. JONES.

[A mistake in the identity of the species concerned probably accounts for the extraordinary divergence in the nesting habits of the Gourami as described by various authors. It is possible that the species whose nesting habits were described by M. Carbonnier (*Ann. Mag. Nat. Hist.*, vol. xix, p. 274, 1877) was not the true Gourami (*Osphronemus goramy* Lacépède) but one of the other Anabantoid fishes which habitually constructs a 'bubble' nest. Many fishes of this group bear a general resemblance in form and have the same distinctive prolongation of the ventral fin rays into long thread-like appendages, and require for their correct identification a little more than the cursory examination possible through the glass of an aquarium. Further, it should be indicated that the popular name of Gourami has been generally applied not only to the true *Gourami* (*O. goramy*) but to various Anabantoid fishes of different genera such as *Trichogaster*, *Colisa*, *Helostoma* and *Trichopsis*; some of which, such as *Trichogaster trichopterus*, and *Trichopsis vittatus*, were formerly included, with the true Gourami, under the genus *Osphronemus*. Dr. Kyle (*Biology of Fishes*) gives the name Gourami to fishes of the genus *Trichogaster* and illustrates the bubble nest of *Trichogaster labiosus* (= *Colisa labiosus* Day) which he calls the Thick-lipped Gourami. *Colisa labiosa*, like the true Gourami, is marked with irregular bands across its sides; only these markings are more vividly coloured—light, blue-green bands alternating with darker bars of orange brown. Another distinctive feature in this species is that the lips of the male are thickened and more prominent than in the female. The true Gourami on the other hand is a sombre coloured fish, its general colour is dark brown with a few irregular whitish bands across the body. Also in this species there is no marked and prominent thickening of the lips in the male. Carbonnier, in his description of the nesting habits, gives no clue to the colouration of the nest builder, he refers however to the 'brilliant' colours of the male—a character by no means strikingly apparent in the true Gourami. Further his description of the lips of the male which he says were 'tumented in an abnormal fashion' seem to indicate that the species he was dealing with was not the true Gourami (*O. goramy*) but *Colisa labiosa* Day, formerly known as *Trichogaster labiosa*, the thick-lipped Gourami, which habitually builds a bubble nest. Gilbert's description of the nesting habits of the 'Gourami' which appeared in the Society's *Journal* is probably again a case of mistaken identity. He describes his

Gourami as 'jet black with red eyes' a description which hardly fits the colouring of the true Gourami. Further he expresses surprise that his 'Gourami' weighing not more than three or four penny weights should breed. The average weight of the breeding Gourami would run into as many pounds and more. The necessity for careful identification of the species in recording breeding habits is made clear. Writers who have subsequently referred to the 'bubble nest' of the true Gourami have probably accepted Carbonnier's original description. The most recent of these is Innes (*Exotic Aquarium Fishes*, 1935) who writing of the Gourami (*O. gourami*) refers to them as 'bubble nest' builders and qualifies his account by stating that they do not usually breed in aquaria. Which is probably correct as the usual type of aquaria do not provide these fishes with the conditions or the facilities for constructing the 'nest' of reeds which they build for the reception of the eggs.—EDS.]

XXV.—FRESH WATER FISHES OF NORTH GUJRAT.

This is a list of fishes collected in one season in 1936 from the Sabarmati River and one or two tanks neighbouring Ahmedabad. These specimens were originally to form part of an extensive collection from all sources around this city, but owing to unavoidable circumstances, the work was indefinitely postponed.

The fishes collected by the author, together with some other from Prof. J. J. Asana of the Gujrat College, were submitted to Dr. S. L. Hora who very kindly identified and named them. Each of the species mentioned has got a separate Gujrati name, but due to conflicting nomenclature prevalent here, it is thought advisable not to include the vernacular synonyms in the present note. In a future note, it is intended to give these, together with new material; also an attempt will be made to give a short description of the several fishing places which provide for the Ahmedabad market and information on the economic side of the Fishing Industry in this part of the Presidency.

The present collection has been handed over to the Gujrat Natural History Society for their museum.

MASTACEMBELIDÆ.

1. *Mastacembelus pancalus* (Ham.).
2. *Mastacembelus armatus* (Lacep.).

NOTOPTERIDÆ.

3. *Notopterus notopterus* (Pallas).

CYPRINIDÆ.

4. *Labeo fimbriatus* (Bloch).
5. *Labeo calbasu* (Ham.).
6. *Labeo dussumieri* (C. & V.).
7. *Labeo potail* (Sykes).
8. *Labeo boggut* (Sykes).